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The effects on tourism of airfare subsidies for residents: The key role of packaging strategies

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ABSTRACT

Airfare subsidies for residents in remote tourism destinations can negatively affect the local tourism industry. In this paper, we study the effects of airfare subsidies on a remote region's tourism sector with a theoretical model of air transport and tourism service transactions involving a remote tourism region, the rest of the country and the rest of the world. We show that firms' widespread packaging strategies in tourism markets, i.e. selling tourism packages composed of air transport and tourism services at a single price, acts as hidden price discrimination, since the packages are cheaper than buying the services separately. Thus, in the presence of higher airfares due to a subsidy, the tourists not entitled to the subsidy have incentives to switch to a cheaper alternative, namely tourism packages. Consequently, a packaging strategy can lessen or even avoid the negative impacts of the subsidy on a region's tourism sector.

1. Introduction

Airfare subsidies have been introduced in some territories despite international aviation law and regulations advocating free air transport markets (e.g. Billete de Villemeur, 2004; Fu et al., 2010). As stated by Valido et al. (2014), such policy measures can be only justified by the presence of market failures or for equity reasons. As highlighted by these authors, the so-called outermost regions of the European Union (EU) constitute a paradigmatic case in this respect. These regions are overseas territories whose residents, as an exception to the European legislation, receive subsidies on airfares when travelling to the rest of their country. It goes without saying that traveling from (to) a remote region to (from) the rest of the country relies mainly on air transport, particularly when these territories are islands, so these subsidies aim to compensate the disadvantages due to remoteness that are not endured by other national citizens.

However, airfare subsidies for residents may have undesirable effects linked to possible airfare price rises that might have a crowding-out effect of passengers who are not entitled to the subsidy. These concerns have given rise to a number of empirical and theoretical research studies. For instance, Fageda et al. (2016) analysed the impacts on airfares of subsidies introduced in Spain during the period 2003-2013, while the theoretical work of Valido et al. (2014) studied the inefficiencies generated by such subsidies, as non-resident passengers may be expelled from the market.

Previous studies have focused on the effects of subsidies on air transport markets and leave aside the analysis of other economic impacts on remote regions. Importantly, some impacts might become an issue if their economies are mostly based on tourism (Bråthen and Halpern, 2012). Indeed, airfare subsidies may lead to a significant expansion of transport demand by residents to visit the rest of the country, thus causing a rise in the prices of airline tickets for subsidised air routes. As a consequence, tourism flows from the rest of the country might be reduced, cutting down the rents earned by the remote region's tourism sector.

The Spanish tourism region of the Canary Islands is a prototypical case in this respect. This archipelago is an outermost region of the EU, where the tourism sector amounted to 35.2% of GDP and 40.3% of employment in 2017 (Exceltur and de Canarias, 2018). In 2018, the Spanish government raised the ad-valorem subsidy for archipelago residents from 50% to 75% of the market airfare.[1] Thus, these subsidies involve a difference between the reduced airfares paid by residents and

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[1] As reported by Fageda et al. (2016), the subsidy rate in the archipelago was set at 12% in 1960, rose to 33% in 1962, 45% in 2005, 50% in 2006 and 75% in 2018.

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the market airfares earned by airlines. More specifically, residents only pay 25% of market airfares, while the national government pays the remainder 75% to the airlines. This large increase in the subsidy could well have sizeable impacts on the regional tourism industry. This calls for an in-depth analysis in order to identify potential adverse effects and policy measures or firms' strategies to manage them. For this purpose, this paper studies the effects of an ad-valorem subsidy for residents on the performance of another sector, namely the tourism industry, which produces complementary services. More specifically, we explore how a packaging strategy – widely used in the tourism sector – results in hidden price discrimination that benefits both transport and local tourism firms. To our knowledge, no previous attempt has been made in this direction.

Our analysis involves not only the transport price on the air route connecting the region with the rest of the country, but also the price of tourism services supplied in the region. Note that the price of local tourism services is also affected by international tourists coming from the rest of the world. Therefore, an additional price must be taken into account, namely, the transport price for the air route that connects the region with the rest of the world.

It is important to highlight that the tourism demand from the rest of the country tends to represent a significant share in this kind of remote destination. In the case of islands and other remote regions of the EU the share of nationals in tourism demand - share of country residents in overnight stays in tourism accommodation - ranges from around 10% in the case of the Balearic Islands, Canary Islands, Madeira and Islands of the Aegean and Crete; 14% in Ionian Islands; 43% in Azores; and between 50% and 86% in Corsica, Sardinia and French Overseas Departments (Eurostat, 2019). Moreover, literature has shown that tourism flows to island regions from mainland countries are mainly determined by income in the origin regions of tourists and prices of flight tickets (Gundelfinger-Casar and Coto-Millán, 2018). Consequently, rises in air prices due to airfare subsidies for residents could greatly affect tourism flows from the rest of the country.

The impact of airfare subsidies for residents on the regional tourism sector seems to rely on the transport firms' ability to discriminate prices between passengers who are eligible for subsidies, i.e. residents, and passengers who are not. However, this type of price discrimination is forbidden by law (Vissers et al., 2014; Borgesius and Poort, 2017). This prohibition suggests that a rise in the transport price could greatly reduce the flows of incoming passengers from the rest of the nation, with the consequent contraction in the tourism production and profits earned by the tourism sector in the remote region. Nevertheless, here we highlight that, in the case of tourism, there exists the possibility of hidden price discrimination (Magenheim and Murrell, 1988) through packaging. Indeed, packaging is a distinctive practice in tourism markets and involves the sale of bundles or tourism packages that contain the typical services of a tourism shopping basket. This basket is mainly composed of air transport and accommodation services, but it can also include rental cars, excursions and other recreational activities supplied in the destination (e.g. Wong and Kwong, 2004; Čavlek, 2006; Zhang et al., 2009; Romero and Tejada, 2011; Calveras and Orfila, 2010, 2014, Calveras and Orfila-Sintes, 2019). By packaging transport and destination tourism services, non-residents may purchase a package for an overall price, in which airfares are not observable. In this way, non-residents can opt for either buying directly from firms, thus facing a stand-alone price for each service, or purchasing the tourism package sold at a discounted price. In other words, firms sell services within a tourism package at a lower price than when selling them directly to clients. Consequently, in the presence of higher airfares because of an airfare subsidy for residents, non-residents may have more incentives to buy tourism packages than each service separately. The issue is, then, to what extent this hidden price discrimination, which causes a switch from direct selling to packaging, could alleviate or even prevent a possible contraction of tourism production and profits due to the subsidy.

To answer this question, we develop a theoretical model that represents air transport and tourism transactions involving a remote region, the rest of the country and the rest of the world. We consider two air routes: a national air route, used by passengers with residence in the remote region and national passengers from the rest of the country; and a foreign air route, used by foreign passengers to reach the remote region. Noticeably, air transport and tourism services provided in the destination are complementary goods (e.g. Divisekera, 2002; Álvarez-Albelo and Hernández-Martín, 2012; Wachsman, 2006; Álvarez-Albelo et al., 2017), though not necessarily perfect complements. The reason lies in the fact that the purpose of the trip for some passengers could be to visit friends or relatives, and hence not all air passengers will demand tourism services at the destination. Moreover, residents do not need to buy air tickets to consume the tourism services supplied in the region. However, inbound holiday tourists typically demand both air transport and tourism services. Indeed, owing to their specific characteristics, some holiday tourists would be interested in purchasing these services jointly as a bundle or tourism package (e.g. Sheldon and Mak, 1987; Yoon and Shafer, 1997; Pearce, 2008), provided that the package is offered at a discount price, that is to say, at a price lower than buying the services separately.

As in Valido et al. (2014) and Forsyth and Dwyer (2002), we consider that air transport and tourism markets operate under imperfect competition, namely, firms have market power. For the sake of simplicity, in the model, we assume that each air route is operated by a different monopolist firm, and the tourism services are also provided by a monopolist firm based in the region. Firms can sell their services directly to their clients (direct selling) and jointly as a tourism package (bundling). In the latter case, each transport firm and the tourism firm undertake a packaging strategy or policy that creates additional demand for tourism packages and results in lower joint prices. The package prices are determined through mutually beneficial agreements between firms, which are reflected in revenue sharing contracts (e.g. Wang et al., 2004; Giannoccaro and Pontrandolfo, 2004; Cachon and Lariviere, 2005; Guo and He, 2012). Thus, the firms agree upon the package prices and the share of joint profits from sales. Competition à la Bertrand between each transport firm and tourism firm determines the stand-alone prices for the respective services.

Therefore, the model contains both stand-alone prices from direct selling and the prices of tourism packages from the packaging policy. In this setting, the airfare subsidy for residents can cause the stand-alone ticket price on the national air route to rise. In this scenario, passenger flows from the rest of the nation will be reduced, diminishing the production and profits of the tourism firm based in the region. Even so, these adverse effects might be compensated by an increase in incoming tourists attracted by a higher price discount linked to the packaging strategy. Consequently, the net impact on the region's tourism sector relies on the opposing effects of the subsidy on the demand segment of direct selling and the demand segment of tourism packages.

The remainder of the paper is organised as follows. Section 2 offers a review of related literature. Section 3 presents the model. Section 4 solves for stand-alone and package prices in equilibrium. Sections 5 shows the impacts of a higher ad-valorem subsidy on air transport and tourism markets. Section 6 discusses the results. Lastly, section 7 summarises and concludes.

2. Related literature

The provision of air transport services has been recognised as a key factor for social and economic development of remote regions. There are currently two main subsidy programs, namely, the Essential Air Services (EAS) in the US and the Public Service Obligation (PSO) in the EU, involving direct subsidies and route-based regulation (e.g. Williams and Pagliari, 2004; Bråthen and Halpern, 2012; Pita et al., 2013; Gössling et al., 2017; Fageda et al., 2018). Bråthen and Halpern (2012) highlighted the catalytic effects of air transport on remote regions, as more and cheaper air transport services can improve the performance of other economic sectors as well as consumers' welfare. Since an improvement in the provision of air transport services encourages both air travel to and from a remote region, these authors stress that in the case of the tourism sector these effects could be either positive, if net inbound tourism flows increase, or negative, if there is a rise in net outbound tourism flows.

This paper is concerned with studying the impact of an airfare ad-valorem subsidy for residents on the tourism sector of a remote region, and not on assessing the welfare effects of the subsidy. Most of these regions are islands and, therefore, have a strong dependence on air transport (McElroy and Parry, 2010). Moreover, tourism specialisation of small islands and its contribution to economic growth and performance is a topic that has been frequently highlighted (Brau et al., 2007; Scheyvens and Momsen, 2008; Croes, 2013; Pratt, 2015; Bojanic and Lo, 2016).

Therefore, this analysis is pertinent and relevant for remote tourism regions, as subsidies may result in higher airfares for non-resident passengers, and hence in a significant contraction of the tourism production and profits in the region. It is worth noting that, under such a scenario, the economic driving force of the region's economy could be seriously compromised. Although such negative impacts of the subsidy cannot be avoided via direct price discrimination between residents and non-residents (Vissers et al., 2014; Borgesius and Poort, 2017), here we emphasise that there is also the possibility of hidden price discrimination via packaging, which is a common practice in tourism markets (e.g. Wong and Kwong, 2004; Čavlek, 2006; Zhang et al., 2009; Romero and Tejada, 2011; Calveras and Orfila, 2010, 2014, Calveras and Orfila-Sintes, 2019). As an example, according to the European Commission (2015), about 60% of Europeans travelled with tourism packages in 2014. Thus, in the presence of the aforementioned hidden price discrimination, the subsidy may stimulate the demand for tourism packages, sold at a discount price, while discouraging the direct selling of transport and tourism services.

The argument we have just expounded is based on the fact that a subsidy for residents brings about an expansion in demand and, consequently, a rise in transport prices. Thus, as a first task, we must survey the literature to ascertain if this could be the case. As indicated by Valido et al. (2014), the literature has mainly focused on studying subsidies to transport companies, while much less effort has been devoted to analysing transport subsidies for passengers having their residence in particular regions. Within the latter branch of the literature, the econometric study by Calzada and Fageda (2012) analysed the impact of air subsidies for residents on airfares in Spanish island regions during the period 2001-2009. They found that airfares were higher on the routes for which subsidies were granted. Fageda et al. (2012) carried out an empirical analysis of airfare differences between domestic and international air markets on routes from the Spanish island of Gran Canaria from winter 2009 to summer 2010. As Gran Canaria belongs to the remote region of the Canary Islands, its residents obtain subsidised airfares when travelling to the rest of the Spanish territory. The authors found that airlines charge relatively higher prices on the subsidised routes, and even Spanish travellers who do not reside in the region pay higher airfares when flying to the remote region than international passengers coming from more distant origin countries. The empirical results by Jiménez et al. (2018) are also worth mentioning, though they refer to maritime transport in Europe in 2016. These authors found that prices per kilometre were 40% higher for the subsidised routes because of subsidies for resident passengers. On the contrary, the econometric work by Fageda et al. (2016) found that the increase from 33% to 50% in the subsidy for residents in the Canary Islands during the period 2003-2013 had no effect on airfares in a large sample of domestic air routes.

The work by Valido et al. (2014) is the only theoretical study that analyses this topic. Their study deals with the aforementioned potential crowding-out effect and the welfare impacts of both ad-valorem and specific subsidies. The findings show that passengers who are not entitled to the subsidy, i.e. national non-resident passengers, may be expelled from the market when the proportion of resident passengers is high enough. Moreover, specific (ad-valorem) subsidies turn out to be a better (worse) option in terms of welfare when the proportion of passengers with high willingness to pay is low (high) enough.

The welfare assessment of subsidies has been extensively studied in the literature (e.g. Dillén, 1995; Collie, 2006; Valido et al., 2014; Hwang et al., 2015). By contrast, as mentioned before, here we are not concerned with welfare evaluation, but with the potential counterproductive effects of subsidies. This question is not new in the literature, as it has been analysed in different contexts. For instance, empirical literature has shown that public subsidies for R&D, aimed at avoiding undesirable underinvestment in these activities, can actually discourage private R&D (Zúñiga-Vicente et al., 2014). Moreover, subsidy programs for improving energy efficiency in the residential sector may give rise to a so-called rebound effect, which leads to a higher energy consumption (Aydin et al., 2017). Also, subsidising efficient irrigation technologies in the agricultural sector may not promote water conservation (Medellín-Azuara et al., 2012). In the present paper, airfare subsidies for residents, besides causing a crowding-out effect, may also shrink the tourism sector of the remote region, which can be considered a potential counterproductive effect and whose intensity is analysed in the next sections.

Since our main hypothesis relies on the compensation effect of the packaging policy of firms, we must review some of the literature on this subject. Packaging is a common strategy of firms when goods present some degree of complementarity (e.g. Yan and Bandyopadhyay, 2011; Yan et al., 2014; Jeitschko et al., 2017). This is the case of the typical goods and services that make up the tourism shopping basket. These goods and services are produced by different firms, which requires interfirm transactions that are reflected in contracts in order to build up tourism packages. In this context, the coordination of the tourism supply chain becomes an issue. In tourism markets, this coordination is carried out by intermediaries, such as tour-operators and travel agencies (Čavlek, 2006). Besides facilitating the coordination among firms, tourism intermediaries help reduce the search costs of tourism services and solve asymmetric information problems (e.g. Calveras and Orfila, 2010, 2014, Calveras and Orfila-Sintes, 2019), which creates additional tourism demand.

The literature on the coordination among firms that make up a supply chain is abundant (e.g. Wang et al., 2004; Giannoccaro and Pontrandolfo, 2004; Cachon and Lariviere, 2005). In the field of tourism economics, the theoretical work of Guo and He (2012) studied the coordination in a tourism supply chain involving hotels and tour-operators, which is reflected in revenue sharing contracts. Also, the work by Álvarez-Albelo et al. (2017) used the revenue sharing contract designed by Cachon and Lariviere (2005) to represent the coordination between tourism firms in a destination and an international tour-operator. In the present paper, we consider that national and international air transport companies act as tourism intermediaries, and these firms and the tourism firm based in the region sign revenue sharing contracts like the one developed by Cachon and Lariviere (2005). This type of contract implies the existence of perfect coordination of the tourism supply chain, which yields maximum joint profits of all firms involved. The joint profits are then shared out among the firms according to their bargaining power that, for simplicity, we assume to be exogenously given (Ara and Ghosh, 2016).

In our analysis, passengers and tourists can buy air transport and tourism services directly from the firms (direct selling), or buy both types of services jointly as a tourism package (bundling). For modelling these two kinds of demand segments, we consider the demands in Yan and Bandyopadhyay (2011). These authors develop a framework in which a firm supplies two imperfect complementary goods, and implements a packaging policy that results in the creation of additional demand for packages. However, they assume that the direct selling demands are not served by the firm when a packaging policy is undertaken. In our setting, instead, we assume that firms serve both the demands from direct selling and the demands for packages, as is commonly observed in tourism markets.

Lastly, note that the determination of stand-alone prices for each service and the prices of tourism packages is a crucial question to our analysis. It was also a central issue in the work of Jeitschko et al. (2017), as they studied bundling and pricing by rival firms. These authors assumed that a package price is determined by firms in a non-cooperative way, that is to say, there is no coordination among firms. In our framework, however, coordination must exist since it is a prevalent characteristic of tourism markets. Consequently, we assume that stand-alone prices are determined non-cooperatively through firm competition à la Bertrand, while bundle prices are set in a cooperative way through revenue sharing contracts signed by air transport and tourism firms.

3. The model

We develop a model that represents the transactions of air transport and tourism services, denoted as *TR* and *T*, respectively, involving a remote tourism region, the rest of the country and the rest of the world.

We consider two air routes: national and foreign air routes, denoted as *NR* and *FR*, respectively. The *NR*, which is operated by a monopolist firm, connects the tourism region with the rest of the country. The passengers who travel on the *NR* are residents in the tourism region and are denoted as *R* that stands for residents; and residents in the rest of the country who are denoted as *N* that stands for nationals. The *FR*, which is also operated by a monopolist firm, connects the tourism region with the rest of the world. We assume that only residents in the rest of the world, denoted as *F* that stands for foreigners, travel on the *FR*. For simplicity, we do not consider air flows of residents in the region to the rest of the world, since the number of resident passengers is assumed to be small relative to the total demand on the international route, and hence has a negligible impact on airfares on the *FR*.

Tourism services supplied in the region are demanded by a share of residents in the region, a share of passengers from the rest of the country, and a share of passengers from the rest of the world. For simplicity, we assume that these services are provided by a monopolist tourism firm based in the region. In this respect, we leave aside the demand for tourism services in the rest of the country by residents in the region. The reason for this assumption lies in the fact that this demand is small with respect to the national demand, and hence it could hardly affect tourism prices in the rest of the nation.

In accordance with actual behaviour in the tourism markets, transport and tourism firms can sell their services either directly to their clients (direct selling) or as a bundle or tourism package, denoted as *B*, including a unit of transport services and a unit of tourism services (bundling).

The air transport and tourism demands are divided in five and three segments, respectively. We consider the linear demand functions in Yan and Bandyopadhyay (2011), as they can suitably represent the direct selling demands and the demands for tourism packages.

3.1. Direct selling demands for air transport

The demand segments involving national and foreign passengers are assumed to be symmetrical and independent, and take the form:

$$x_{TR}^{j}=a_{TR}^{j}-bp^{i}-b\theta q, \quad b>0, \quad 0\leq\theta<1, \quad i=NR,FR, \quad j=N,F, \tag{1}$$

where x_{TR}^{j} denotes the quantity demanded of transport services by nationals and foreigners, p^i represents the price of transport on national and foreign air routes and q is the price of tourism services supplied in the region. Parameter a_{TR}^{j} is the market base or potential demand if the services were offered for free. Parameter b captures the sensitivity of demand to the transport price. Since nationals and foreigners may also want to buy tourism services in the remote region, demands depend negatively on the tourism price. As in Yan and Bandyopadhyay (2011), this implies that these services exhibit some degree of complementarity that is captured by parameter θ. The degree of complementarity increases as the value of θ rises. Obviously, the services are independent if $\theta=0$ and, as we aim to consider aggregate direct selling demands, it is sensible to assume that the services can never be perfect complements, and hence $\theta<1$.

The demand function of residents in the remote tourism region is represented as:

$$x_{TR}^{R}=\overline{a}_{TR}^{R}-b\Omega p^{NR}, \quad \Omega\equiv1-s, \quad s\in[0,1), \quad \overline{a}_{TR}^{R}>0, \quad b>0, \tag{2}$$

where x_{TR}^{R} is the quantity demanded. The parameter Ω stands for an ad-valorem subsidy with rate s. Since the transport demand by residents is assumed to have a negligible impact on the price of tourism services offered in the rest of the country, this price is assumed to be exogenous and captured by parameter $\overline{a}_{TR}^{R}$.[2]

3.2. Direct selling demand for tourism services supplied in the region

The demand for tourism services from direct selling includes that of national and foreign agents as well as the one of residents in the tourism region, and takes the form:

$$x_{T}=a_{T}-bq-b\theta\left(p^{NR}+p^{FR}\right), \quad a_{T}>0, \quad b>0, \quad 0\leq\theta<0, \tag{3}$$

where x_T is the quantity demanded, which depends negatively on the tourism price and, because of imperfect complementarity, also on air transport prices in the national and foreign air routes.

3.3. Demands for bundles or tourism packages

Transport and tourism firms also face the demands for bundles or tourism packages, composed of one unit of transport services and one unit of tourism services. These segments come as a result of firms' packaging policy. Firms reach mutually beneficial agreements to sell their services as a tourism package at a discount price. In the model, the demands for bundles of national and foreign tourists can be written as:

$$x_{B}^{j}=a_{B}^{j}-bp_{B}^{i}+\lambda\left(p^{i}+q-p_{B}^{i}\right), \quad a_{B}^{j}>0, \quad 0<\lambda\leq b, \quad i=NR,FR, \quad j=N,F, \tag{4}$$

where x_{B}^{j} denotes the quantity demanded by nationals and foreigners. It is worth noting that, since a bundle or package is composed of one unit of transport services and one unit of tourism services, x_{B}^{j} also denotes the quantity demanded of each type of service. The bundle price on the national and foreign air routes is denoted as p_{B}^{i}. In the demand for tourism packages, tourists compare the cost of buying the services separately, i.e. the sum of stand-alone prices, p^i+q, with the cost of purchasing them jointly, p_{B}^{i}. Thus, the larger the price discount associated with the bundles is, i.e. the wider the difference $p^i+q-p_{B}^{i}$, the higher the demands for bundles become, where parameter λ captures the extent to which this strategy of firms is successful in creating additional demands. In other words, as stated by Yan and Bandyopadhyay (2011), λ captures the efficacy of the packaging policy.

[2] The transport demand can be written as $x_{TR}^{R}=a_{TR}^{R}-b\Omega p^{NR}-b\theta\tilde{q}$, where a_{TR}^{R} is the market base and $\tilde{q}$ is the exogenous tourism price in the rest of the country. Thus, we can rewrite the demand as (2), where $\overline{a}_{TR}^{R}\equiv a_{TR}^{R}-b\theta\tilde{q}$.

3.4. Assumptions on market bases

As commented previously, all passengers who travel to the tourism region demand air transport services, but not all of them demand tourism services. It is also sensible to assume that the demands from the rest of the world are greater than those from the rest of the country. Likewise, as the remote region is considered a tourism region, we assume that the transport demand by residents is lower than the demand by nationals. For the model to reflect these facts, it is necessary to make the following assumptions on market bases in the demand functions:

$$\overline{a}_{TR}^{R} < a_{TR}^{N} < a_{TR}^{F}, \quad a_T < a_{TR}^{N} + a_{TR}^{F}, \quad a_B^N < a_B^F. \tag{5}$$

3.4. Packaging policy and revenue-sharing contracts

The transport firms on each air route and the tourism firm reach mutually beneficial agreements to sell their services jointly. In doing so, the transport firms that, for simplicity, we consider integrated with a tour operator, purchase a share of the production of tourism services from the firm based in the region, construct tourism packages and sell them to national and foreign tourists. As commented previously, these types of interfirm transactions, which reflect tourism supply chains, are typical in the tourism industry.

To determine package prices, firms sign revenue-sharing contracts that imply the maximization of joint profits from producing tourism packages. In other words, we assume perfect coordination of the supply chains. In this respect, we consider the contract described in Cachon and Lariviere (2005, p. 33), which involves two parameters: the shares of firms in revenues and the prices earned by the tourism firm.

Under this contract, the profits of the transport firms on the national and foreign air routes and the profits of the tourism firm associated with this demand segment become equal to:

$$\pi_{TR}^{i} = \phi p_B^i x_B^j - (c + \widehat{p}_B) x_B^j, \quad i = NR, FR, \quad j = N, F, \tag{6}$$

$$\pi_{T}^{i} = (1-\phi) p_B^i x_B^j - (\kappa - \widehat{p}_B) x_B^j, \quad i = NR, FR, \quad j = N, F, \tag{7}$$

respectively, where ϕ and $1-\phi$ denote the shares of transport and tourism firms in revenues, respectively, $\widehat{p}_B$ is the price earned by the tourism firm, and c and κ denote the marginal costs of transport and tourism firms, respectively. Adding up (6) and (7) gives the total profits from selling tourism packages, i.e. $\pi_{TR}^i + \pi_T^i = (p_B^i - (c+\kappa))x_B^j$. Setting $\widehat{p}_B = \phi(c+\kappa) - \kappa$ obtains that each firm earns the profits:

$$\pi_{TR}^{i} = \phi\left(p_B^i - (c+\kappa)\right) x_B^j, \quad i = NR, FR, \quad j = N, F, \tag{8}$$

$$\pi_{T}^{i} = (1-\phi)\left(p_B^i - (c+\kappa)\right) x_B^j, \quad i = NR, FR, \quad j = N, F, \tag{9}$$

where $\phi \in (0,1)$ depends on the negotiation power of the parties, which is assumed to be the same in both contracts. As stated by Cachon and Lariviere (2005), the bargaining power can be made endogenous by assuming that firms have outside opportunity profits. Thus, a firm would only sign the contract if it earned equal or higher profits than outside opportunity profits. This would shorten the feasible value range for ϕ. Since there is no need to rely on an endogenous bargaining power to illustrate the main ideas in this paper, we follow Ara and Ghosh (2016) and opt for keeping the analysis as simple as possible by assuming that ϕ is exogenously given. The conflict and cooperation along the tourism value chain, which determines parameter ϕ, has been widely analysed in tourism literature (e.g. Buhalis, 2000; Medina-Muñoz et al., 2003; Guo and He, 2012; Calveras, 2019). However, there is no empirical evidence on the bargaining power of parties. In addition, it is worth noting that $\widehat{p}_B$ takes negative values whenever $\phi < \kappa/(c+\kappa)$. If this were the case, the tourism firm (the seller) would be devoting a share of its revenues to subsidise the transport firm (the buyer).

3.5. Firms' profits

The profit functions of transport firms on national and foreign air routes are:

$$\Pi_{TR}^{NR} = \underbrace{\left(p^{NR} - c\right)\left(x_{TR}^{N} + x_{TR}^{R}\right)}_{\text{Direct selling}} + \underbrace{\phi\left(p_B^{NR} - (c+\kappa)\right)x_B^N}_{\text{Bundling}}, \tag{10}$$

$$\Pi_{TR}^{FR} = \underbrace{\left(p^{FR} - c\right)x_{TR}^{F}}_{\text{Direct selling}} + \underbrace{\phi\left(p_B^{FR} - (c+\kappa)\right)x_B^F}_{\text{Bundling}}, \tag{11}$$

respectively, which include the profits from the direct selling segments and from the revenue sharing contract (bundling). Lastly, the profit function of the tourism firm also comes from the demand segment of direct selling and from the packaging policy, and can be written as:

$$\Pi_T = \underbrace{(q-\kappa)x_T}_{\text{Direct selling}} + \underbrace{(1-\phi)\left(\left(p_B^{NR} - (c+\kappa)\right)x_B^N + \left(p_B^{FR} - (c+\kappa)\right)x_B^F\right)}_{\text{Bundling}}. \tag{12}$$

4. Equilibrium prices

We assume that firms make their price decisions in two stages. Firms first decide their stand-alone prices p^i and q, and then sign revenue sharing contracts to determine the bundle prices p_B^i. The model is solved by backward induction.

Given the stand-alone prices, the maximization of $\pi_{TR}^i + \pi_T^i = (p_B^i - (c+\kappa))x_B^i$ gives rise to the bundle prices, the quantities of bundles and the joint profits on both air routes:

$$p_B^i = \frac{a_B^j + \lambda(p^i + q)}{2(b+\lambda)} + \frac{c+\kappa}{2}, \quad i = NR, FR, \quad j = N, F, \tag{13}$$

$$x_B^j = \frac{a_B^j + \lambda(p^i + q) - (b+\lambda)(c+\kappa)}{2}, \quad i = NR, FR, \quad j = N, F, \tag{14}$$

$$\pi_{TR}^i + \pi_{AC}^i = \frac{1}{4(b+\lambda)}\left(a_B^j + \lambda\left(p^i + q\right) - (b+\lambda)(c+\kappa)\right)^2, \quad i = NR, FR, \quad j = N, F, \tag{15}$$

respectively. Equations (13)–(15) are increasing functions of the sum of stand-alone prices.

After introducing (15) into (10), (11) and (12), the transport and the tourism firms choose their stand-alone prices by maximizing profits, taking other firms' prices as given. The first order condition (FOC) of the maximization problems of transport firms on the national and foreign air routes are:

$$\frac{\partial \Pi_{TR}^i}{\partial p^i} = A_{TR}^i - B_{TR}^i p^i - C_{TR} q = 0 \quad \rightarrow \quad p^i = \alpha_{TR}^i - \beta_{TR}^i q, \quad i = NR, FR, \tag{16}$$

where Appendix A contains the functions of parameters A_{TR}^i, B_{TR}^i, C_{TR}, α_{TR}^i and β_{TR}^i. As for the tourism firm based in the region, the FOC of the problem is:

$$\frac{\partial \Pi_T}{\partial q} = A_T - B_T q - C_T\left(p^{NR} + p^{FR}\right) = 0 \quad \rightarrow \quad q = \alpha_T - \beta_T\left(p^{NR} + p^{FR}\right), \tag{17}$$

where the functions of parameters A_T, B_T, C_T, α_T and β_T appear in Appendix A.

The transport and tourism firms compete à la Bertrand, and the reaction functions of firms are shown in (16) and (17). Obviously, the transport firms do not compete on prices, since they operate on independent air routes. The solution of the reaction functions yields the stand-alone prices in the Nash equilibrium. The existence of Nash equilibrium requires that:

$$q = \frac{\alpha_T - \beta_T(\alpha_{TR}^{NR} + \alpha_{TR}^{FR})}{1 - \beta_T(\beta_{TR}^{NR} + \beta_{TR}^{FR})} > 0 \quad \text{if} \quad \beta_T < \frac{\alpha_T}{\alpha_{TR}^{NR} + \alpha_{TR}^{FR}}, \tag{18}$$

$$p^{NR} = \alpha_{TR}^{NR} - \beta_{TR}^{NR} q > 0 \quad \text{if} \quad q < \frac{\alpha_{TR}^{NR}}{\beta_{TR}^{NR}}, \tag{19}$$

$$p^{FR} = \alpha_{TR}^{FR} - \beta_{TR}^{FR} q > 0 \quad \text{if} \quad q < \frac{\alpha_{TR}^{FR}}{\beta_{TR}^{FR}}. \tag{20}$$

Equations (18)–(20) allow bundle prices, quantities of transport and tourism services and firms' profits in equilibrium to be computed.

5. Impacts of airfare subsidies for residents on air transport and tourism markets

The comparative statics we carry out here consist of studying the response of prices, quantities and profits to changes in an airfare ad-valorem subsidy for residents. This section shows and comments the results, while the calculations are confined to Appendix B.

5.1. Impacts on stand-alone and bundle prices

The result in (21) shows that an increase in *s*, which expands the demand for transport by residents, raises p^{NR}. Since transport and tourism services exhibit some degree of complementarity, the rise in p^{NR} brings about a decline in the tourism price such that $|dq/ds| < dp^{NR}/ds$, as shown in (23). Moreover, equations (22) and (23) reveal that a fall in q augments the transport demand in the *FR*, which causes p^{FR} to increase, in such a way that $dp^{FR}/ds < |dq/ds| < dp^{NR}/ds$:

$$\frac{dp^{NR}}{ds} > 0, \tag{21}$$

$$0 < \frac{dp^{FR}}{ds} < \frac{dp^{NR}}{ds}, \tag{22}$$

$$\frac{dq}{ds} < 0, \quad \frac{dp^{FR}}{ds} < \left|\frac{dq}{ds}\right| < \frac{dp^{NR}}{ds}. \tag{23}$$

Accordingly, an increase in the subsidy raises and reduces the sum of stand-alone prices in the national and foreign air routes, respectively:

$$\frac{d(p^{NR}+q)}{ds} > 0, \quad \frac{d(p^{FR}+q)}{ds} < 0, \quad \left|\frac{d(p^{FR}+q)}{ds}\right| < \frac{d(p^{NR}+q)}{ds}, \tag{24}$$

where from the results in (23) it follows that the decline in $p^{FR} + q$ is lower than the increase in $p^{NR} + q$.

Arising from equation (13), the variation in the bundle prices is lower than the change in the sum of stand-alone prices, since the demands for bundles are more price elastic than the demands for direct selling. On the *NR*, a higher subsidy causes a lower increase in the bundle price than in the sum of stand-alone prices. Consequently, there is a rise in the price discount, $p^{NR} + q - p_B^{NR}$. Conversely, on the *FR*, the bundle price decreases less than the sum of stand-alone prices, thus causing a decline in the price discount, $p^{FR} + q - p_B^{FR}$. Moreover, since $|d(p^{FR} + q)/ds| < d(p^{NR} + q)/ds$, the fall in p_B^{FR} turns out to be smaller than the increase in p_B^{NR}:

$$0 < \frac{dp_B^{NR}}{ds} < \frac{d(p^{NR}+q)}{ds}, \quad \frac{d(p^{FR}+q)}{ds} < \frac{dp_B^{FR}}{ds} < 0, \quad \left|\frac{dp_B^{FR}}{ds}\right| < \frac{dp_B^{NR}}{ds}. \tag{25}$$

5.2. Impacts on the number of passengers

The calculations in Appendix B yield the following relations between the number of passenger of direct selling and the subsidy rate:

$$\frac{dx_{TR}^N}{ds} < 0, \quad \frac{dx_{TR}^R}{ds} > 0, \quad \frac{dx_{TR}^F}{ds} > 0. \tag{26}$$

Since $dq/ds < |dp^{NR}/ds|$, the number of national passengers falls as the subsidy increases. As expected, a higher subsidy raises the number of resident passengers. Therefore, taking together these results, we obtain that a rise in the subsidy causes a crowding-out effect of national passengers by resident passengers who travel on the *NR*. Nevertheless, it is worth noting that this effect refers only to the demand segment for direct selling in which, of course, passengers who travel with tourism packages are not included. Lastly, an increase in the number of foreign passengers in response to a rise in the subsidy is obtained.

So far we have analysed the impact of a higher subsidy on the number of passengers who buy directly from firms. However, there are also the passengers who purchase tourism packages or bundles. We obtained that the number of these passengers on national and foreign air routes increases and decreases, respectively, as the subsidy rises and, from (24), the response of foreign passengers is lower than the response of national passengers:

$$\frac{dx_B^N}{ds} > 0, \quad \frac{dx_B^F}{ds} < 0, \quad \left|\frac{dx_B^F}{ds}\right| < \frac{dx_B^N}{ds}. \tag{27}$$

Now, we are ready to analyse the variation of the total number of national passengers who travel on the *NR*, i.e. $x_{TR}^N + x_B^N$, in order to determine whether or not the aforementioned crowding-out effect is present when we take into account the demand segments of direct selling and tourism packages. In this respect, we obtain that the fall in the number of passengers from direct selling outweighs the increase of passengers who travel with tourism packages. Therefore, national passengers are indeed expelled from the *NR*:

$$\frac{d(x_{TR}^N + x_B^N)}{ds} < 0. \tag{28}$$

Considering (26) and (28), we obtain an ambiguous impact on the total number of passengers in the *NR*, i.e. $x_{TR}^N + x_B^N + x_{TR}^R$:

$$\frac{d(x_{TR}^N + x_B^N + x_{TR}^R)}{ds} \begin{matrix} < \\ = \\ > \end{matrix} 0. \tag{29}$$

Lastly, the variation of the total number of passengers who travel on the *FR*, i.e. $x_{TR}^F + x_B^F$, also remains undetermined:

$$\frac{d(x_{TR}^F + x_B^F)}{ds} \begin{matrix} < \\ = \\ > \end{matrix} 0. \tag{30}$$

However, as shown in Appendix B, $b\theta - \lambda/2 \leq 0$ is a sufficient condition for a negative relation between $x_{TR}^F + x_B^F$ and s to exist. This condition holds for low and high enough values of parameters θ and λ, respectively.

5.3. Impacts on the quantity of tourism services supplied in the region

Regarding the tourism demand for direct selling, we find that an increase in the subsidy brings about a decline in the quantity of tourism services:

$$\frac{dx_T}{ds} < 0. \tag{31}$$

As shown in (27), the quantity of tourism services sold within tourism packages to national and foreign tourists rises and declines, respectively, in response to a higher subsidy. Taking into account (24), we obtain an increase in $x_B^N + x_B^F$ in response to a rise in the subsidy:

$$\frac{d(x_B^N + x_B^F)}{ds} > 0. \tag{32}$$

Lastly, taking together (31) and (32), we find an ambiguous response of the total quantity of tourism services sold, i.e. $x_T + x_B^N + x_B^F$, to a rise in

Table 1
Response of variables to a rise in the subsidy rate (s).

Direct selling	
Stand-alone prices of air transport paid by:	
- Nationals, p^{NR}	rises due to demand expansion caused by a higher s.
- Residents, $(1-s)p^{NR}$	falls because of a higher s.
- Foreigners, p^{FR}	rises due to demand expansion caused by a lower q. Moreover, it holds that $\uparrow p^{FR} < \uparrow p^{NR}$.
Stand-alone price of tourism services paid by:	
- All tourists, q	falls due to the complementarity between tourism and air transport services. Moreover, it holds that $\uparrow p^{FR} < \downarrow q < \uparrow p^{NR}$.
Number of passengers:	
- Nationals, x_{TR}^{N}	falls because $\downarrow q < \uparrow p^{NR}$.
- Residents, x_{TR}^{R}	rises because of a lower $(1-s)p^{NR}$.
- Foreigners, x_{TR}^{F}	rises because $\uparrow p^{FR} < \downarrow q$.
Quantity of tourism services purchased by:	
- All tourists, x_T	falls because $\downarrow q < \uparrow (p^{NR} + p^{FR})$.
Bundling	
Bundle price paid by:	
- National tourists, p_{B}^{NR}	rises because $\uparrow (p^{NR} + q)$.
- Foreign tourists, p_{B}^{FR}	falls because $\downarrow (p^{FR} + q)$.
Price discount enjoyed by:	
- Nationals, $p^{NR} + q - p_{B}^{NR}$	rises because $\uparrow (p^{NR} + q) > \uparrow p_{B}^{NR}$.
- Foreigners, $p^{FR} + q - p_{B}^{FR}$	falls because $\downarrow (p^{FR} + q) > \downarrow p_{B}^{FR}$. Moreover, it holds that $\downarrow (p^{FR} + q - p_{B}^{FR}) < \uparrow (p^{NR} + q - p_{B}^{NR})$.
Quantity of bundles purchased by:	
- Nationals, x_{B}^{N}	rises because of demand expansion caused by a higher price discount.
- Foreigners, x_{B}^{F}	falls because of demand contraction caused by a lower price discount.
- Both, $x_{B}^{N} + x_{B}^{F}$	rises as $\downarrow x_{B}^{F} < \uparrow x_{B}^{N}$.

the subsidy. However, $b\theta - \lambda/2 < 0$ is a sufficient condition for a positive relation to be obtained:

$$\frac{d\left(x_T + x_B^N + x_B^F\right)}{ds} \begin{matrix} > \\ = \\ < \end{matrix} 0 \quad \text{and} \quad b\theta - \lambda/2 < 0 \Rightarrow \frac{d\left(x_T + x_B^N + x_B^F\right)}{ds} > 0. \tag{33}$$

Therefore, whenever θ and λ take low and high enough values, respectively, the rise in the quantity bought within tourism packages exceeds the fall in the quantity purchased directly from the tourism firm.

5.4. Impacts on firms' profits

The complexity of the equations prevents us from determining analytically the impact of a higher subsidy on firms' profits. Indeed, as shown in Appendix B, we cannot determine the impact on profits from direct selling of the transport firm on the national air route, since the number of passengers can increase or decrease, while the stand-alone price rises. Moreover, there is a rise in profits from selling tourism packages. Notwithstanding, the relation between Π_{TR}^{NR} and s would be positive provided that there were a small enough change in the number of passengers from direct selling. Under this condition, the transport firm in the *NR* would enjoy higher profits as the subsidy increases.

As for the transport firm on the *FR*, profits from direct selling increase, since there is a rise in both price and quantity. Conversely, profits from packaging decrease due to the fall in the sum of stand-alone prices.

Lastly, the impact on profits earned by the tourism firm remains undetermined. From previous results, we know that there is a decline in profits from direct selling. However, the sum of stand-alone prices rises and falls on the national and foreign air routes, respectively, and so do the profits from the packaging policy on the respective air routes. However, given that $\left|d(p^{FR} + q)/ds\right| < d(p^{NR} + q)/ds$, we conjecture that profits from packaging might become higher as the subsidy increases.

5.5. Hidden price discrimination and the switch from direct selling to packaging

Once the theoretical results have been obtained, it is useful to consider them altogether to better understand how packaging operates in alleviating or even avoiding tourism contraction in a remote region due to a higher residents' airfare subsidy in the region. The results are summarised in Table 1.

Let us first consider the demand segments of direct selling, in which customers purchase air transport and tourism services separately from firms. An increase in the subsidy causes an expansion in transport demand on the *NR* and, consequently, a rise in the transport price on this route, p^{NR}. As transport and tourism are complementary services, the increase in p^{NR} leads to a decline in the price of tourism services sold in the region, q. The increase in the subsidy has a direct impact on p^{NR} and an indirect impact on q, and thus the increase in p^{NR} turns out to be greater than the decrease in q. Moreover, the decline in q expands the transport demand on the *FR*, which results in an increase in the transport price of this route, p^{FR}. However, this rise in p^{FR} is smaller than the decline in q and the increase in p^{NR}. Therefore, p^{FR} is the stand-alone price least affected by the rise in the subsidy.

These price changes will affect the number of passengers who travel on both air routes as well as the quantity of tourism services sold in the region. Indeed, as a result of price changes, nationals – not entitled to the subsidy – travel less, i.e. x_{TR}^{N} falls, because travelling on the *NR* is now more expensive. As expected, residents travel more, i.e. x_{TR}^{R} rises, since they have subsidised airfares. Lastly, foreigners travel more, i.e. x_{TR}^{F} rises, because the decline in the tourism price has caused an expansion in the transport demand on the *FR*. Importantly, there is a decline in the quantity of tourism services sold in the region, x_T, because the increase in air transport prices on both routes have caused a contraction of the tourism demand for direct selling.

The results of direct selling expounded so far have entailed an adverse impact on the region's tourism sector. Indeed, both the fall in the quantity of tourism services and the tourism price lead to a decline in the tourism profits earned by the region. Therefore, the tourism sector would be adversely affected by an increase in the subsidy if only direct selling were present. The reason is that travelling to the remote region has become more expensive for tourists not entitled to the subsidy.

Under these circumstances, packaging emerges as a strategy to lessen or even circumvent the adverse effects of the subsidy on the tourism industry. Packaging is a widely used strategy in tourism markets, since it allows firms to increase their demand and profits. This strategy consists of selling air transport and tourism services jointly, as a tourism package, at a single price. It is worth emphasising that bundling enables a price reduction of air transport and tourism services when bought jointly. Thus, transport and tourism firms apply a price discrimination between customers who buy the services separately and pay higher prices (direct selling), and those who buy them jointly and pay an overall lower price (bundling). This strategy entails hidden price discrimination, since customers only know the overall price of the tourism package, composed of air transport and tourism services, and not the price of each service separately. In this way, in the presence of a higher subsidy that increases transport prices, bundling emerges as a cheaper alternative for tourists, which gives rise to an increase in the demand for tourism packages.

Let us see now how the increase in the subsidy causes a switch of national tourists from relatively more expensive direct selling to relatively cheaper tourism packages. Firstly, it should be remembered that the demand for tourism packages is driven by the price discount, that is to say, the difference between the cost of buying air transport and tourism services separately and the cost of buying them jointly. In this way, there will be an expansion in demand for packages provided that buying the services separately (direct selling) becomes relatively more expensive than purchasing them as a package (bundling). In this respect, it is important to realise that absolute price changes are not what matters, but relative price changes.

As explained previously, a rise in the subsidy leads to a higher transport price in the *NR* and to a lower tourism price, in such a way that the cost for a national tourist of buying both services separately increases, i.e. $p^{NR}+q$ rises. The rise in $p^{NR}+q$ causes the package price sold in the *NR*, p_B^{NR}, to increase. However, since the demand for bundles or packages is more price elastic than the demands in direct selling, the increase in $p^{NR}+q$ is greater than the rise in p_B^{NR}. Consequently, the price discount associated with a package in the *NR*, i.e. $p^{NR}+ \ q- \ p_B^{NR}$, is increased, thus making tourism packages relatively cheaper than buying both services separately. As commented before, this increase in the price discount expands the demand for bundles in the *NR* and, as a result, the quantity of bundles sold x_B^N rises. This means that national tourists opt for travelling more with tourism packages than independently (direct selling), since it has become relatively cheaper. Noticeably, the tourism firm in the region earns more profits from selling bundles to national tourists, since both price and quantity have increased.

The effects of a higher subsidy on the demand for packages by foreigners are the opposite but, as expected, they are quantitatively lower than those experienced on the *NR*. Indeed, higher subsidy causes the transport price in the *FR* to increase and the tourism price to fall, in such a way that buying both services separately becomes cheaper, i.e. $p^{FR}+q$ falls. This causes the package price p_B^{FR} to fall by less than the sum of stand-alone prices, $p^{FR}+q$. As a consequence, the price discount associated with a package, $p^{FR}+q-p_B^{FR}$, decreases. This decrease leads to a contraction in the demand for packages in the *FR*, and hence to a fall in the quantity of packages sold, x_B^F. As a result, tourism profits from selling packages to foreign tourists shrink. However, since the impact of a higher subsidy is lower in the *FR* than in the *NR*, there is an increase in the total quantity of tourism packages sold, i.e. $x_B^N+x_B^F$ rises, and expectedly, the tourism profits earned from selling packages increase.

The results commented so far show that, when the national government sets a higher subsidy, some national tourists switch from buying the services separately (direct selling) to purchasing them jointly (bundling). This change of behaviour lies in the fact that packages become relatively cheaper than buying the services separately. The question is then to what extent this switch could alleviate or even prevent tourism contraction in the remote region due to a higher subsidy. The answer depends on the efficacy of the packaging strategy, which is measured by the sensitivity of the demands for packages to changes in the price discount. Indeed, we have found that a high enough efficacy gives rise to an increase in the total quantity of tourism services sold in the region, i.e. $x_T+x_B^N+x_B^F$ rises, thus avoiding tourism contraction in the remote region.

5.6. Numerical examples

Disambiguation of some theoretical results requires a numerical solution of the model, which we undertake in the present sub-section. More specifically, we consider values for the ad-valorem subsidy ranging from 0 to 0.75, i.e. $s\in[0,0.75]$. The upper bound of s is equal to the actual value set in the outermost region of the Canary Islands, which is a paradigmatic case. With these values, we compute prices, quantities and profits in equilibrium. The numerical exercises we perform here not only identify the parameter values that give rise to different signs of some derivatives, but also provide insights into the quantitative response of variables to a progressive increase in the subsidy.

The parameter values for computing numerically the model appear in Table 2. The last row of the table defines two cases in order to show the different results regarding the impacts of a higher subsidy on the regional tourism sector. More specifically, the cases differ in parameters θ and λ. It is worth remembering that θ measures the degree of complementarity in demand functions of direct selling, while λ captures the extent to which the packaging policy of firms is successful in creating additional demands. Case 1 involves a higher and a lower value of θ and λ, respectively, than Case 2. A look at equation (33) reveals that in Case 1, it holds that $b\theta-\lambda/2>0$. By contrast, in Case 2, it holds that $b\theta-\lambda/2<0$, which yields a rise in the total quantity of tourism services.

Figs. 1 and 2 depict the change in significant variables of the model in Cases 1 and 2, respectively.

As expected, in Fig. 1, the results show that the transport price on the foreign air route, p^{FR}, and the tourism price, q, barely change in response to rises in the subsidy. However, we observe a substantial increase in the transport price on the *NR*, p^{NR}, which is directly affected by the subsidy. Consistent with our theoretical results, we obtain an increase in the price discount in the *NR*, $p^{NR}+q-p_B^{NR}$, and a slight decrease in the price discount in the *FR*, $p^{FR}+q-p_B^{FR}$.

The total number of passengers who travel on the *NR*, $x_{TR}^N+x_B^N+x_{TR}^R$, rises, which means that the upturn in the number of resident passengers and national passengers travelling with tourism packages outweighs the fall in the number of national passengers of direct selling. By contrast, the total number of passengers who travel on the *FR*, $x_{TR}^F+x_B^F$, barely falls as the subsidy increases.

In accordance with our theoretical analysis, a progressive increase in the subsidy leads to a fall in the total quantity of tourism services sold in the region, $x_T+x_B^N+x_B^F$.

Table 2
Parameter values in the numerical analysis.

Ad-valorem airfare subsidy for residents: $s\in[0,0.75]$
Bargaining power of firms: $\phi=0.4$, $1-\phi=0.6$
Firms' marginal costs: $c=10$, $\kappa=10$
Market bases in the demand functions:
$\overline{a}_{TR}^R=100$, $a_{TR}^N=150$, $a_{TR}^F=250$
$a_T=200$
$a_B^N=100$, $a_B^F=150$
Price sensitivity parameters in the demand functions: $b=1$
Case 1: $\theta=0.4$, $\lambda=0.5$
Case 2: $\theta=0.3$, $\lambda=1$

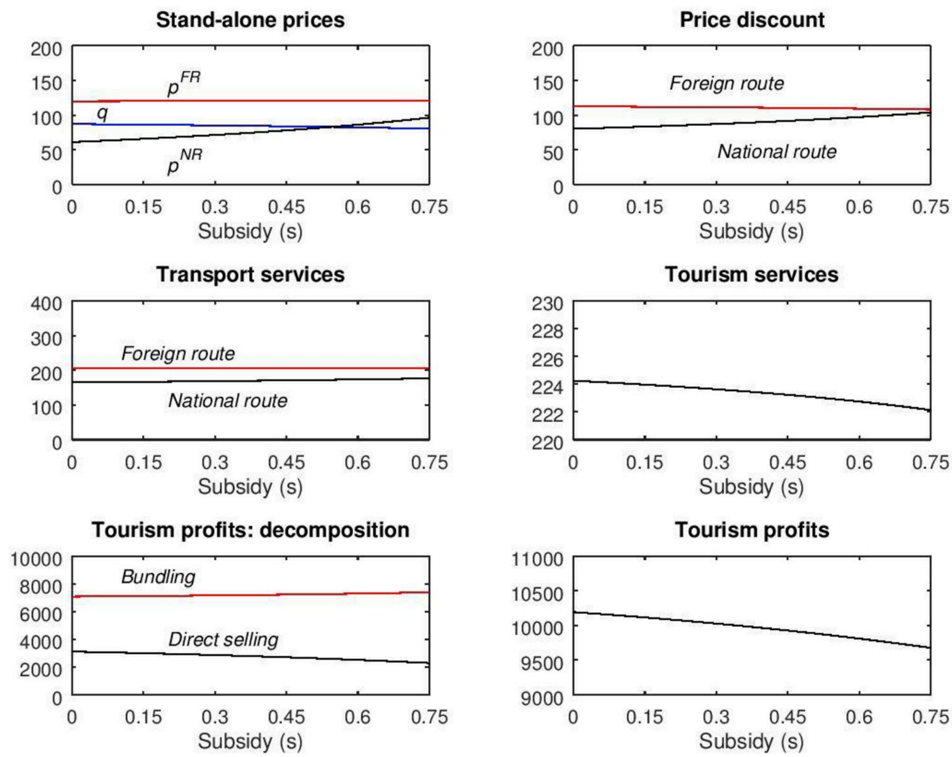

Fig. 1. Equilibrium response to increases in the subsidy. Case 1: $\theta = 0.4, \quad \lambda = 0.5$.

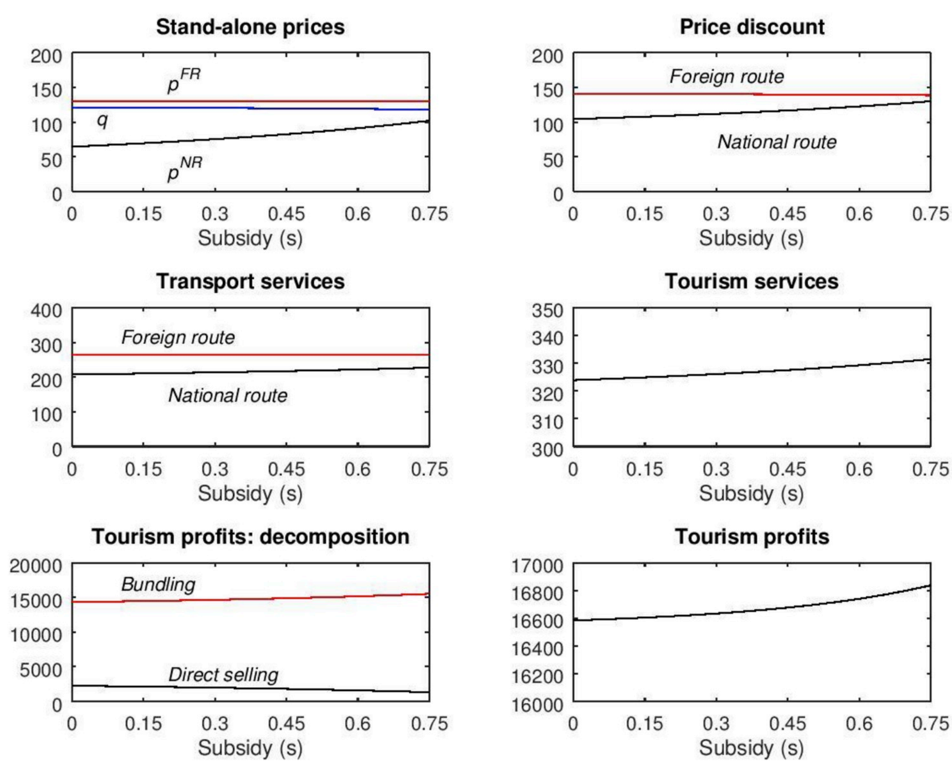

Fig. 2. Equilibrium response to increases in the subsidy. Case 2: $\theta = 0.3, \quad \lambda = 1$.

Lastly, profits of the transport firms that operate on both air routes augment, though these results are not shown in the figure. The profits from direct selling of the tourism firm fall while, as conjectured previously, profits from selling tourism packages (bundling) increase. In this case, the value of θ is high, and hence the tourism demand of direct selling is reduced greatly by the increase in the transport price. This behaviour reinforces the fall in profits from direct selling. Moreover, parameter λ takes a low value, which entails a limited efficacy of the policy in creating additional demands for tourism packages, which weakens the rise in profits from bundling. Consequently, the total profits earned by the tourism firm in the region fall.

As for the results depicted in Fig. 2, the qualitative behaviour of prices and the quantity of transport services is similar to that in Case 1. Also in this case, there is an increase in profits of transport firms on both air routes. However, the quantitative behaviour of the price discount in the *NR* deserves to be commented on. Indeed, the figures show that the price discount turns out to be higher in Case 2 than in Case 1, since the bundling policy is more effective in the latter case. Consistently, Case 2 involves a greater growth in the demand for bundles, which results in an increase of the total quantity of tourism services sold in the region. Regarding profits of the tourism firm, the lower value of θ moderates the decline in profits from direct selling, while the higher value of λ strengthens the increase in profits from bundling. As a result, a rise in total profits of the tourism firm is obtained.

6. Discussion of results

We have just shown that the potential negative impacts on the tourism industry of a remote region of introducing an ad-valorem subsidy for residents may be overcome with firms' packaging policies. Noticeably, these policies create an additional demand for tourism packages and hidden price discrimination. This result is relevant to remote tourism regions, like some outermost regions of the EU, inasmuch as packaging is a prevalent strategy to manage the tourism supply chain.

With regard to the impacts on air transport markets, we have shown that the ad-valorem subsidy always gives rise to a crowding-out effect of national passengers. This result contrasts with that obtained in Valido et al. (2014), where this effect was found only when the proportion of resident passengers is high enough. This difference in results comes from the fact that Valido et al. (2014) assume that passengers are heterogeneous in their willingness to pay. This feature creates incentives for the airline to undertake price discrimination, charging different prices to passengers with high and low willingness to pay. As already commented, we do not consider any kind of explicit price discrimination, since we aimed to show that the hidden price discrimination linked to the bundling policy of firms could be enough to circumvent a possible contraction of the tourism industry.

We want to highlight that our model involves stringent assumptions in order to avoid any bias on the effects of the subsidy on the tourism sector in any direction, either positive or negative. More specifically, in direct selling demands, we do not resort to either dissimilar price sensitivities or different degrees of complementarity but, consider symmetrical demands for each service. Furthermore, we assume that the structure of revenue sharing contracts is independent of the value of the subsidy rate. Hence, the response of variables to changes in the subsidy comes solely from price reactions. Furthermore, the existence of monopolist firms is a significant assumption in our model, since when firms enjoy the highest market power, they can increase the subsidy pass-through to airfares (Pless and van Benthem, 2017). Nonetheless, even under these harsh assumptions, we have found that a negative impact on the tourism sector could be avoided by reinforcing the packaging policy of firms.

One might wonder whether a public policy could yield the same outcome. Though this is not the objective of this paper, our analysis seems to suggest that it would be necessary to implement a set of policies aiming at, first, improving equity between resident and non-resident passengers and, second, circumventing the potential negative impacts on the tourism industry. In this line, the substitution of the ad-valorem subsidy for a specific subsidy could be considered as a way to achieve both objectives. The only difference between ad-valorem subsidies – a percentage on the flight ticket – and specific subsidies – a fixed amount per flight ticket – refers to their impacts on prices. The former subsidies make the demand curve steeper and hence have greater effects on prices. By contrast, the latter ones do not affect the demand curve slope, which results in smaller effects. Note, however, that although a specific subsidy has milder impacts on prices, quantities and profits, introducing these subsidies in our model would not alter the results qualitatively.

A key question on the subject we are dealing with is the impact of the subsidy for residents on airfare prices. As discussed in the literature review, previous empirical analysis indicates that subsidies do raise airfares on the subsidised route. However, this might not be the case if airline strategies to capture the subsidy via price augmentation are frowned upon by potential customers. In other words, these types of strategies may be viewed as extractive and detrimental to the efficacy of a public policy that is implemented for equity reasons. Under these circumstances, air companies could opt to limit the increase in flight prices so as not to face loss of social reputation, and hence of demand and profits. This aspect is related to the concept of corporate social responsibility, which has been a widely analysed topic in the literature (McWilliams et al., 2006). Kirwan (2009) empirical findings on the incidence of agricultural subsidies on farmland rental rates in the USA illustrate the type of behaviour we have just expounded. Another example of the role of reputation in avoiding price increases due to subsidies is the case of the tax incentives for the Toyota Prius in the US market (Salle, 2011). Perhaps, social norms could explain the aforementioned empirical results in Fageda et al. (2016), which showed no airfare increases in the subsidised air routes. Nevertheless, this goodwill strategy of firms aimed at avoiding a loss of reputation could change in the medium-long term, whenever an external cause, such as an increase in the oil price, creates incentives for price rises.

It should also be noted that bundling can be considered as a way of avoiding transparency in pricing, in the sense that it could allow charging a higher stand-alone price than the hidden price that is charged within the package. This kind of hidden price discrimination has been considered one of the economic rationales for bundling (Evans and Salinger, 2005). In addition, Rao and Klein (2013) define this effect of bundling in the case of high-tech firms as disguised price discrimination.

Our theoretical results need to be empirically tested, as was previously tested the response of airfares to increases in the subsidy for resident passengers in the Canary Islands (Calzada and Fageda, 2012; Fageda et al., 2012, 2016). In this respect, the increase of the subsidy from 50% to 75% in the Canary Islands is an ideal natural experiment for testing empirically our results. The task requires suitable econometric analysis and data, which is clearly beyond the scope of this paper. However, our theoretical study can offer some guidance to perform this type of analysis. Indeed, statistical information on airfares on the subsidised route and tourism prices in the region, besides air passengers and tourism flows to the remote region, is required.

7. Conclusion

Since travelling to and from distant regions is mainly based on air transport, airfare subsidies for residents have been introduced for equity reasons. Even so, this type of policy may have two counterproductive effects. First, it might give rise to a crowding-out effect of national air passengers who are not entitled to the subsidy, as shown by Valido et al. (2014). Second, higher airfares generated by greater demand due to the subsidy may reduce tourism flows, thus causing a contraction in the region's tourism sector. Noticeably, the latter effect is of utmost importance to remote tourism regions, like the Spanish region of the Canary Islands, whose inhabitants receive high ad-valorem subsidies when travelling to the rest of the country.

The aim of this study has been to analyse the second effect which, to our knowledge, has not been hitherto addressed. To this purpose, we have developed a theoretical model that represents air transport and tourism transactions involving a remote tourism region and the rest of the country and the world. In the model, the national government provides an ad-valorem airfare subsidy to residents in the region. We have found that the subsidy brings about a crowding-out effect of passengers coming from the rest of the country, as shown by previous literature. Indeed, the impact of the subsidy relies on price discrimination between passengers who have the subsidy and those who do not. Though such a practice is forbidden by law, here we have emphasised that, in the case of tourism, there exists the possibility of hidden price discrimination through firms' bundling policy. This possibility is far from being unimportant, as it is a prevailing strategy in the management of tourism supply chain. Indeed, in our model, we have shown that buying tourism packages on the national air route becomes relatively cheaper than purchasing each service separately, which may result in higher tourism production and profits. Therefore, an expansion in the demand for tourism packages takes place as firms reinforce their bundling policy.

Our analysis suggests that the private sector can play a crucial role in lessening or even avoiding the adverse effects of airfare subsidies on the tourism industry of a remote region. Indeed, the bundling policy undertaken by firms in tourism markets can not only solve search costs, asymmetric information and coordination problems, but also fix undesirable effects of public policies, as shown in this paper. There are some useful avenues for further research to be carried out. The most evident is related to the welfare implications of airfare subsidies for residents. Another extension is the design of alternative policy mechanisms to achieve the subsidy's goal more efficiently. Further theoretical analysis, including firms' marketing decision to create additional demand for tourism packages, and an empirical test of our results also constitute relevant matters for future research.

Appendix A

The functions of parameters in equation (16) are:

$$A_{TR}^{NR} \equiv a_{TR}^{N} + \overline{a}_{TR}^{R} + \frac{\lambda\phi}{2(b+\lambda)}a_{B}^{N} + b(1+\Omega)c - \frac{\lambda\phi}{2}(c+\kappa) > 0,$$

$$B_{TR}^{NR} \equiv 2b(1+\Omega) - \frac{\lambda^2\phi}{2(b+\lambda)} > 0,$$

$$A_{TR}^{FR} \equiv a_{TR}^{F} + \frac{\lambda\phi}{2(b+\lambda)}a_{B}^{F} + bc - \frac{\lambda\phi}{2}(c+\kappa) > 0,$$

$$B_{TR}^{FR} \equiv 2b - \frac{\lambda^2\phi}{2(b+\lambda)} > 0,$$

$$C_{TR} \equiv \theta b - \frac{\lambda^2\phi}{2(b+\lambda)} > 0,$$

$$\alpha_{TR}^{i} \equiv \frac{A_{TR}^{i}}{B_{TR}^{i}} > 1, \quad \beta_{TR}^{i} \equiv \frac{C_{TR}}{B_{TR}^{i}} < \frac{1}{2}, \quad i = NR, FR.$$

Likewise, the functions of parameters in equation (17) are:

$$A_T \equiv a_T + \frac{\lambda(1-\phi)}{2(b+\lambda)}\left(a_B^N + a_B^F\right) + b\kappa - \lambda(1-\phi)(c+\kappa) > 0,$$

$$B_T \equiv 2b - \frac{\lambda^2(1-\phi)}{b+\lambda} > 0,$$

$$C_T \equiv b\theta - \frac{\lambda^2(1-\phi)}{2(b+\lambda)} > 0,$$

$$\alpha_T \equiv \frac{A_T}{B_T} > 1, \quad \beta_T \equiv \frac{C_T}{B_T} < \frac{1}{2}.$$

Regarding the functions of parameters, A_{TR}^{i} and A_T are assumed to be positive, since they include the market bases. The functions B_{TR}^{i} and B_T are positive, which guarantees that the solution of the three problems is a maximum. Lastly, we assume that the expressions C_{TR} and C_T take positive values. This is a sensible assumption, since it implies that the players' price decisions are strategic substitutes as air transport and tourism services supplied in the region are complementary goods (Yalcin et al., 2013). Consequently, the reaction functions in (16) and (17) are downward sloping.

Appendix B

This appendix contains the calculations of comparative statics shown in Section 5. It is worth mentioning that, for tractability, here we analyse the impacts of a change in $\Omega \equiv 1 - s$ on relevant variables. Thus, the impacts of a variation in s will exhibit the opposite signs to those obtained. The results in Appendix A are used to determine the signs of some relations.

B.1. Impacts on stand-alone and bundle prices

The impact on stand-alone prices can be easily computed by differentiating equations (16) and (17) with respect to p^i, q and Ω, which gives:

$$\frac{dp^{NR}}{d\Omega} = -\frac{b(2p^{NR}-c)\left(1-\beta_{TR}^{FR}\beta_T\right)}{\left(1-\beta_T(\beta_{TR}^{NR}+\beta_{TR}^{FR})\right)B_{TR}^{NR}} < 0,$$

$$\frac{dp^{FR}}{d\Omega} = -\frac{b(2p^{NR}-c)\beta_{TR}^{FR}\beta_T}{\left(1-\beta_T(\beta_{TR}^{NR}+\beta_{TR}^{FR})\right)B_{TR}^{NR}} < 0,$$

$$\frac{dq}{d\Omega} = -\frac{b(2p^{NR}-c)\beta_T}{(1-\beta_T(\beta_{TR}^{NR}+\beta_{TR}^{FR}))B_{TR}^{NR}} > 0.$$

The results in (21), (22) and (23) follow from the three previous calculations. The effects on the package prices on the national and foreign air routes can be computed using (13) and (24):

$$\frac{dp_B^{NR}}{d\Omega} = \frac{\lambda}{2(b+\lambda)}\frac{d(p^{NR}+q)}{ds} < 0,$$

$$\frac{dp_B^{FR}}{d\Omega} = \frac{\lambda}{2(b+\lambda)}\frac{d(p^{FR}+q)}{ds} > 0.$$

B.2. Impacts on the number of passengers

To analyse the effect of a higher subsidy on the number of passengers of direct selling we use demand functions (1) and (2), and also the impacts of a higher subsidy on stand-alone prices computed in sub-section B.1 of this appendix. The results in (26) come from the three following relations:

$$\frac{dx_{TR}^N}{d\Omega} = -b\left(\frac{dp^{NR}}{d\Omega}+\theta\frac{dq}{d\Omega}\right) = \frac{b^2(2p^{NR}-c)\left(1-\beta_T\left(\beta_{TR}^{FR}+\theta\right)\right)}{(1-\beta_T(\beta_{TR}^{NR}+\beta_{TR}^{FR}))B_{TR}^{NR}} > 0,$$

$$\frac{dx_{TR}^R}{d\Omega} = -b\left(p^{NR}+\frac{dp^{NR}}{d\Omega}\Omega\right) = -b\left(p^{NR}-\frac{b\Omega(2p^{NR}-c)\left(1-\beta_{TR}^{FR}\beta_T\right)}{(1-\beta_T(\beta_{TR}^{NR}+\beta_{TR}^{FR}))B_{TR}^{NR}}\right) < 0,$$

$$\frac{dx_{TR}^F}{d\Omega} = -b\left(\frac{dp^{FR}}{d\Omega}+\theta\frac{dq}{d\Omega}\right) = -\frac{b^2(2p^{NR}-c)\beta_T\left(\theta-\beta_{TR}^{FR}\right)}{(1-\beta_T(\beta_{TR}^{NR}+\beta_{TR}^{FR}))B_{TR}^{NR}} < 0.$$

Note that, from the functions defined in Appendix A, it holds that $\beta_{TR}^{FR} < \theta$, and hence $dx_{TR}^F/d\Omega < 0$.

Regarding the response of the number of passengers who purchase tourism packages, using (14) and (24) we obtain:

$$\frac{dx_B^N}{d\Omega} = \frac{\lambda}{2}\underbrace{\frac{d(p^{NR}+q)}{d\Omega}}_{(-)} < 0, \qquad \frac{dx_B^F}{d\Omega} = \frac{\lambda}{2}\underbrace{\frac{d(p^{FR}+q)}{d\Omega}}_{(+)} > 0,$$

where, for the sake of clarity, from now on the signs of the derivatives will be indicated between parentheses.

Using previous results we obtain the sign of the relation in (28), referring to the response of national passengers to an increase in the subsidy:

$$\frac{d\left(x_{TR}^N+x_B^N\right)}{d\Omega} = -\left(b-\frac{\lambda}{2}\right)\underbrace{\frac{dp^{NR}}{d\Omega}}_{(-)} - \left(b\theta-\frac{\lambda}{2}\right)\underbrace{\frac{dq}{d\Omega}}_{(+)} > 0.$$

Likewise, the ambiguous sign in (29) comes from:

$$\frac{d\left(x_{TR}^N+x_B^N+x_{TR}^R\right)}{d\Omega} = -bp^{NR} - \left(b(1+\Omega)-\frac{\lambda}{2}\right)\underbrace{\frac{dp^{NR}}{d\Omega}}_{(-)} - \left(b\theta-\frac{\lambda}{2}\right)\underbrace{\frac{dq}{d\Omega}}_{(+)} \gtreqless 0.$$

Lastly, the ambiguous response of the total number of passengers who travel in the *FR* in equation (30) is obtained from:

$$\frac{d\left(x_{TR}^F+x_B^F\right)}{d\Omega} = -\left(b-\frac{\lambda}{2}\right)\underbrace{\frac{dp^{FR}}{d\Omega}}_{(-)} - \left(b\theta-\frac{\lambda}{2}\right)\underbrace{\frac{dq}{d\Omega}}_{(+)} \gtreqless 0.$$

It is worthwhile to note that $b\theta-\lambda/2 \le 0$ is a sufficient condition for a positive relation between $x_{TR}^F + x_B^F$ and Ω to exist.

B.3. Impacts on the quantity of tourism services supplied in the region

Using (3), (21), (22) and (23) and the results in Appendix A, we obtain a positive relation between x_T and Ω, and hence a negative relation between x_T and s as shown in (31):

$$\frac{dx_T}{d\Omega} = -b\left(\frac{dq}{d\Omega}+\theta\frac{d(p^{NR}+p^{FR})}{d\Omega}\right) = \frac{b^2(2p^{NR}-c)(\theta-\beta_T)}{(1-\beta_T(\beta_{TR}^{NR}+\beta_{TR}^{FR}))B_{TR}^{NR}} > 0,$$

where, from Appendix A, we know that $\beta_T < \theta$.

Considering (24), we obtain the result in (32), namely, the total quantity of tourism services sold within packages increases as the subsidy rises:

$$\frac{d\left(x_B^N+x_B^F\right)}{d\Omega} = \frac{\lambda}{2}\underbrace{\frac{d(p^{NR}+q)}{d\Omega}}_{(-)} + \frac{\lambda}{2}\underbrace{\frac{d(p^{FR}+q)}{d\Omega}}_{(+)} < 0.$$

Lastly, we find that $b\theta - \lambda/2 < 0$ is a sufficient condition for the existence of a negative relation between the total amount of tourism services sold, i.e. $x_T + x_B^N + x_B^F$, and Ω, which gives the result in (33):

$$\frac{d\left(x_T + x_B^N + x_B^F\right)}{d\Omega} = -(b-\lambda)\underbrace{\frac{dq}{d\Omega}}_{(+)} - \left(b\theta - \frac{\lambda}{2}\right)\underbrace{\frac{d(p^{NR}+p^{FR})}{d\Omega}}_{(-)} \overset{>}{\underset{<}{=}} 0.$$

B.4. Impacts on firms' profits

The response of firms' profits to a variation in Ω are:

$$\frac{d\Pi_{TR}^{NR}}{d\Omega} = \underbrace{(p^{NR}-c)\underbrace{\frac{d\left(x_{TR}^N + x_{TR}^R\right)}{d\Omega}}_{(\text{Ambiguous sign})} + \left(x_{TR}^N + x_{TR}^R\right)\underbrace{\frac{dp^{NR}}{d\Omega}}_{(-)}}_{\text{Direct selling}} + \underbrace{\lambda\phi\left(p^{NR}-(c+\kappa)\right)\underbrace{\frac{d(p^{NR}+q)}{d\Omega}}_{(-)}}_{\text{Bundling}},$$

$$\frac{d\Pi_{TR}^{FR}}{d\Omega} = \underbrace{(p^{FR}-c)\underbrace{\frac{dx_{TR}^F}{d\Omega}}_{(-)} + x_{TR}^F\underbrace{\frac{dp^{FR}}{d\Omega}}_{(-)}}_{\text{Direct selling}} + \underbrace{\lambda\phi\left(p^{FR}-(c+\kappa)\right)\underbrace{\frac{d(p^{FR}+q)}{d\Omega}}_{(+)}}_{\text{Bundling}},$$

$$\frac{d\Pi_T}{d\Omega} = \underbrace{(q-\kappa)\underbrace{\frac{dx_T}{d\Omega}}_{(+)} + x_T\underbrace{\frac{dq}{d\Omega}}_{(-)}}_{\text{Direct selling}} +$$

$$\underbrace{\lambda(1-\phi)\left(\left(p^{NR}-(c+\kappa)\right)\underbrace{\frac{d(p^{NR}+q)}{d\Omega}}_{(-)} + \left(p^{FR}-(c+\kappa)\right)\underbrace{\frac{d(p^{FR}+q)}{d\Omega}}_{(+)}\right)}_{\text{Bundling}}.$$

Appendix C. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jairtraman.2020.101772.

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